An Evaluation of Metals and Hydrocarbon Field Screening Methodology for Enhanced Soil Contamination Delineation

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Background/Objectives. During horizontal and vertical delineation of soil impacts, the use of field screening methodology unlocks the potential for significant cost savings by reducing the necessity for costly expedited laboratory turnaround times and/or drill rig remobilization. The use of field screening equipment can provide critical real-time information for field personnel to make decisions on whether to step-out/step-down delineation is needed, and enable an adaptive, targeted program. As our results show, field screening methodology also comes with its own unique drawbacks, including but not limited to: increased labor costs, lower analytical resolution than laboratory data, and challenges gaining regulatory approval. The proposed presentation evaluates performance of the use of a hand-held x-ray fluorescence (XRF) to analyze for metals, specifically arsenic, via EPA Method 6200, and oil range hydrocarbons via Petroflag. The XRF was selected over a comparable chemical test kit for field screening due to an anticipated large sample volume.

Approach/Activities. At a confidential site, the authors employed the use of a hand-held XRF analyzer, and Petroflag, to assist in a site investigation with soil impacted with heavy metals (arsenic specifically) and petroleum hydrocarbons. Within each boring, a sample was collected every foot, homogenized and analyzed in triplicate with the XRF for arsenic, resulting in over 250 XRF analyses. In addition to XRF, samples were collected in borings with suspected hydrocarbon impacts based on staining and olfactory, and analyzed via Petroflag. XRF and Petroflag results were compared with site screening levels, and based on that comparison, field personnel decided whether to continue with horizontal and/or vertical delineation. Samples were collected in parallel and sent to a laboratory to verify results and evaluate field screening methodology performance.

Results/Lessons Learned. The average relative percent difference (RPD) between the 31 sets of XRF and laboratory arsenic analyses was 33.7. Of the 31 sets of parallel samples, only four sets had results where the site-specific screening level fell between the results, resulting in an 88% success rate for field decision-making. The poor repeatability is suspected to be due to the small sample amount and heterogeneity within the subsurface material, which could be mitigated by analyzing multiple samples within one boring depth or homogenizing a larger sample prior to performing the XRF analysis in triplicate. Due to the obvious evidence of hydrocarbon impacts at this site, Petroflag results confirmed what was already suspected, and offered minimal value added. Despite elevated equipment rental costs, and increased labor, the field screening approach resulted in significant cost savings.